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Abstract

During the 14th Five-Year Plan period, the development of the emerging industries of strategic importance enters into a new stage and starts a journey from a brand new starting point. The development of the emerging industries should fully utilize their supporting and protecting roles to the transformation of an economic society, their pioneering and leading functions to innovationdriven development, and their positive impact on expanding employment and encouraging entrepreneurship. Hence, it helps China to elevate overall industry competitiveness, comprehensive economic power, and international division of work. This study conducts profound analysis on the rule of development, as well as the future growth trend of emerging industries of strategic importance. It illustrates issues in the six major aspects of the emerging industries, namely, innovative development, digital transformation, fundamental capability, service system, policy research, and international competition.

Keywords

14th Five-Year Plan, emerging industries, strategic importance, rules of development, growth trend

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Thinking on Development of Emerging Industries of Strategic Importance in New Stage

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Abstract: During the "14th Five-Year Plan" period, the development of the emerging industries of strategic importance enters into a new stage and starts a journey from a brand new starting point. The emerging industries should fully play their supporting and protecting roles in the transformation of an economic society, fulfill their pioneering and leading functions in innovation-driven development, and exert their positive impacts of expanding employment and encouraging entrepreneurship. This will help China to elevate overall industry competitiveness, comprehensive economic power, and international division of work. This study profoundly analyzes the rule of development as well as the growth trend of emerging industries of strategic importance. It illustrates issues in the six major aspects of the emerging industries, namely, innovative development, digital transformation, fundamental capability, service system, policy research, and international competition.
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Keywords: 14th Five-Year Plan; strategic importance; emerging industries; rules of development; growth trend

The Fifth Plenary Session of the 19th Central Committee of the Communist Party of China made important arrangements for accelerating the development of the modern industrial system and promoting the optimization and upgrading of the economic system, and put forward clear requirements on the development of the emerging industries of strategic importance, which is of far-reaching significance for revitalizing the real economy and building China into a manufacturing power. During the "14th Five-Year Plan" period, the reform and opening up and the socialist modernization usher in a new stage of high-quality development. Profound changes in domestic and international environments have brought about new opportunities and challenges. We must seize and make good use of strategic opportunity, adapt to new changes, turn adversity into opportunities, and ride on momentum to accelerate the establishment of a new development paradigm featuring dual circulation, in which domestic and overseas markets reinforce each other, with the domestic market as the mainstay. The development of the emerging industries of strategic importance enters into a new stage and starts a journey from a brand new starting point. The emerging industries should fully play their supporting and protecting roles in the transformation of an economic society, fulfill their pioneering and leading functions in innovation-driven development, and exert their positive impacts of expanding employment and encouraging entrepreneurship. This will help China to elevate overall industry competitiveness, comprehensive economic power, and international division of work. This study profoundly analyzes the rule of development as well as the growth trend of emerging industries of strategic importance, illustrating issues of emerging industries in the following six major aspects.

1 Innovative development

During the "14th Five-Year Plan" period, the innovation and development of the emerging industries of strategic importance can be achieved through the following paths: promoting intelligent manufacturing, green manufacturing, and service manufacturing; improving the modern technological innovation system that features production-research cooperation, open source and openness, independence and controllability, integrated innovation, and international competitiveness; building a multidisciplinary, integrated, and coordinated innovation ecosystem that spans different technologies and fields; making great efforts to enhance the creativity, support and influence of science and technology; accelerating the integrated development of scientific discoveries, technological inventions, engineering construction, economic growth, industrial upgrading, and protection for people's livelihood.

(1) Intelligent manufacturing. Intelligent manufacturing has been regarded by major industrialized countries as the mainstream of the future manufacturing industry, and it is the

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key to improving the adaptability of manufacturing supply structure and fostering new momentum for economic growth. A cluster of intelligent technologies including the fifth-generation mobile communication technology (5G), artificial intelligence (AI), the Internet of Things, cloud computing, blockchain, and digital twin can provide highly scientific, economical, operable, and reliable technological services. Intelligent factories, intelligent logistics, and intelligent network are changing industrial boundaries, manufacturing methods, organizational structures, and management modes profoundly. "Data + computing power + algorithm" enables intelligent decision-making, intelligent production, and intelligent operation. The traditional manufacturing industry will pursue innovative development in such key areas as intelligent robotics, intelligent machine tools, intelligent sensors, intelligent instrumentation, intelligent production lines, and 3D/4D printing. An advanced human-machine interaction manufacturing system composed of intelligent machines and human experts will be established.

(2) Green manufacturing. Green manufacturing is a resource-saving, environmentally optimized, and ecologically sound closed-loop production system and modern manufacturing model that can drive economic and social transformation and high-quality development more cleanly, efficiently, and safely. Green manufacturing, along with green economy, green civilization, and green revolution, has swept the world. The development philosophies of green economy, low-carbon economy, and circular economy should gain a firm foothold. Specifically, green technologies should be applied throughout the process from development planning, R&D and design, material procurement, manufacturing, sales services, to recycling of enterprises. A low-carbon and venous industrial chain and a green supply chain should be created in full swing. This requires the promotion and application of technologies for green development, clean production, energy conservation, environment protection, recycling, renewable manufacturing, and purification and pollution treatment. The economic benefits of enterprises will be in accordance with social and ecological benefits from the development of green manufacturing and green industries. The living quality and happiness index of the people will be fully improved through green growth and lifestyle.

(3) Service and manufacturing industries. Service manufacturing is a new type of industry in which advanced manufacturing and modern services are integrated, and it shifts the focus of traditional manufacturing companies from production-oriented to service-oriented manufacturing. We should innovate the production organization by combining technology with user demand, the resource allocation by increasing the proportion of service elements in input and output, and the business mode by encouraging enterprises to complement each other with productive services and service production. These measures will facilitate the transition from production-centric to service-centric, and tap and release the value-added potential of "manufacturing value chain + service value chain" from both the upstream and downstream ends of traditional manufacturing. Such value-added potential is mainly manifested in the value-added services based on the optimization of product design, enhancement of product functionality, facilitation of product transaction, and product integration. Total factor productivity, the added value of products, and market coverage should be increased continuously.

With the new round of scientific and technological revolution and the industrial transformation in the ascendant, innovation should always be the primary momentum for the development of the emerging industries of strategic importance. New forms of business, new markets, new consumption modes, and new driving forces should be created and expanded. During the "14th Five-Year Plan" period, efforts should be made to develop advanced manufacturing, information network, digital content, green and low-carbon industry, energy-saving and environmental industry, technological service, elderly consumption industry, medical and health, tourism and leisure, and culture and sports. The development in these fields will accelerate the modernization and sustainable development of an information-based society in a new economic stage.

2 Digital transformation

The transition from developing strong capabilities in data, technology and industry to growing into a great power has become a focus of strategic competition among major countries in the world at present and in the future. Through cross-border integration, innovation, iteration, and superimposed development, digital technology has widely penetrated into aspects of national economy. Digital transformation is profoundly changing manufacturing models, production methods, industrial organization, and division of labor. Digital innovation accelerates the revolution in technology, production, management, and system, which converge to be endogenous driver for the development of the emerging industries of strategic importance during the "14th Five-Year Plan" period. Attention should be paid to the digitalization of the following aspects.

(1) Product design. The digitalization of product design can greatly improve the development efficiency, shorten the development cycle, and reduce the development cost. The application of virtual design, concurrent engineering, resource restructuring, and rapid prototyping can better transform data, knowledge, technology and ideas into products, processes, equipment, and services, which can facilitate the virtual, networked, interfaced, platform-based, and service-oriented product design. In this way, product design will play a fundamental role as the source of industrial chain, value chain, and innovation chain. Further, personalized product design, differentiated market competition, and large-scale

customized production will become possible. The digitalization of product design will allow enterprises to survive, develop, and seek transformation in the ever-changing business environment, and to lay a technological foundation for gaining core competitive edge at a deeper level through digital thinking, digital technology, and digital design.

(2) Production process. Digital manufacturing technologies such as computer numerical control (CNC) programming, analog simulation, precise modeling, and real-time decision-making should be adopted to improve production processes and build self-learning, self-perception, self-adaptation, and self-control intelligent production lines, intelligent workshops, and intelligent factories where all types of manufacturing equipment have interconnected prediction, perception, analysis, diagnosis, and control functions. Moreover, these real-time and reliable technologies enable timely responses to random changes in the environment, objects, requirements, procedures, and equipment of processing, and support the adaptation to the complex and diverse manufacturing processes. After production processes become digitalized, the reengineered lean production processes that are digitally empowered can collaboratively solve various problems and create a new manufacturing network that consists of information system and automation system to comprehensively improve the production quality, accuracy, efficiency, momentum, and safety of enterprises.

(3) Market development. According to the principle of user first and product life cycle management, we should introduce the Internet, cloud computing, and Internet of Things to analyze the realistic, future, and potential needs of consumers and users, and holistically study market development, brand building, marketing strategies, and promotion planning. The product flow, material flow, information flow, and capital flow should be regulated, from which professional services such as remote monitoring, diagnosis, and operation and maintenance (O&M) can be derived to provide users with real-time comprehensive solutions of R&D–design–manufacturing–building–maintenance. Besides, efforts should be made to maximize the collaboration and interaction between manufacturing companies, market, and users, build information connectivity, seamless linkage, and intensive production between supply chain, industrial chain, and companies, so that producers and consumers gradually co-create value in a digital environment.

(4) Business decision-making. The value of transition to digital business decision-making should be deeply appreciated from multiple levels, under multiple modes, and in multiple fields. The management of strategy, resources, operation, investment, and finance of enterprises should be integrated and optimized. With the rapid development of digital economy nowadays, data is a strategic asset that represents value and wealth, and computing is an important tool to generate, acquire, analyze, and use data. Data collection, machine learning, and quantitative analysis, when fully applied, will turn into new competitive edges for enterprises. During the "14th Five-Year Plan" period, more and more enterprises will apply digital management methods such as enterprise resource planning (ERP), supply chain management (SCM), and manufacturing execution system (MES). Thus, it is imperative for company leaders, managers, and workers to improve their data thinking and their ability to analyze, manipulate, and process data.

Digital transformation is a progressive system engineering project for the emerging industries of strategic importance. Creating an ecological environment for industrial digitalization and digital industrialization is urgent. Planning and research on digital economy, construction of digital infrastructure, promotion and application of digital technologies, openness and protection of digital resources, standardized management of digital assets, and development of digital industrial clusters should be advanced in the light of local conditions to reshape the micro-foundation of the modern market economy and create an industrial system for digital economy.

3 Fundamental capability

Industrial fundamental capability is an indicator measuring the industrialization and modernization of a country. China has become the second largest economy and the largest manufacturer in the world, whereas the weak fundamental capability of the manufacturing industry hinders the high-quality development and the elevation to the mid-to-high end of the value chain. For example, core software, as a new-generation manufacturing sector, is the cornerstone to connect digital manufacturing, intelligent manufacturing, and network-based manufacturing and is regarded by developed countries as a requisite for their domestic manufacturing to keep dominating the global industrial landscape. In recent years, China has witnessed the growth of many domestic core software manufacturers which focus on developing key technologies and breaking the market monopoly of foreign software to secure a position in the high end of the value chain. However, foreign-funded enterprises still enjoy market and technological advantages in R&D and design, production control, information management, and O&M and services of high-end software. Although China is the only country that operates all the industrial categories defined by the United Nations, to increase the fundamental capability of its industries, China must get rid of the excessive dependence on importing some components, parts, high-end instruments, and major raw materials. In 2019, the self-sufficiency rate of chips in China was only 30%, and the imports were 304 billion dollars; the sensor market in China was valued CNY 218.8 billion, with 80% of mid- and high-end sensor imported; the instrumentation industry had the imports of 52.8 billion dollars, with 90% of high-end instruments sourced from foreign companies; crude oil

import exceeded 500 million tons, accounting for 70.8% of the total crude oil in China; iron ore import topped 1 billion tons, accounting for 87.3% of the total iron ore in China. The dependence on imports of these five products alone severely restricts the development of the basic, processing, equipment, and strategic high-tech industries in China. Another example is the CNC machine tool, a machine tool that can speed up the development of high-end equipment manufacturing industry in China. The upstream sectors of the CNC machine tool industry chain include main raw materials (e.g., steel castings), machine manufacturing (e.g., basic parts and accessories), CNC system manufacturing (e.g., control system and drive system), and peripheral manufacturing (e.g., casting, forging, welding, and mold processing). The downstream sectors mainly involve automotive industry, machinery industry, military industry (e.g., aerospace, shipbuilding, weaponry, and nuclear industry), and high-tech industries represented by electronic information technology. Obviously, the development of CNC machine tools is fundamental and strategic to the competitiveness of manufacturing industry in the country. China is the largest consumer of high-end CNC machine tools and the largest producer of mid- and low-end CNC machine tools in the world. However, Germany, Japan, and the United States are the absolute leaders in the design, manufacturing, and basic research of CNC machine tools and cultivate the global top 10 manufactures in this field. There are more examples than what is listed above.

During the "14th Five-Year Plan" period, we need to endeavor in the following five aspects. Firstly, improving the fundamental capability of industries should always be our strategic focus, and our strategic goals should always be forging strength, making up for shortcomings, and breaking the bottlenecks. Secondly, we need to formulate and implement separate roadmaps and timetables for research, technological innovation, and industrial development of core basic parts and components, key basic materials, advanced basic processes, and basic industrial technologies. Thirdly, we need to make breakthroughs in key generic technologies in important fields as well as in cutting-edge, modern engineering, and disruptive technologies, increase research investments and venture capital, and strengthen joint research, substitution by domestic products, formulation of standards, promotion and application, and international cooperation. Fourthly, we need to constantly improve the maturity of technologies, manufacturing, products, market, and industries for Chinese brands, and to cultivate a number of world-class innovative enterprises that master outstanding core technological capabilities, gather scientific and technological innovation elements, and lead the development of important industries. Last but not least, we must carry forward the transition from a large industrial country to a powerful industrial country, from made in China to created by China, and from a world manufacturing center to a global industrial chain hub.

4 Service system

Small- and medium-sized enterprises are the new forces of the emerging industries of strategic importance, the main contributors of gross domestic product (GDP), the main taxpayers, the main practitioners of technological innovation, and the main providers of jobs. During the "14th Five-Year Plan" period, the service system for small- and medium-sized enterprises that features complete functions, prominent characteristics, standardized operation, and quick and convenient delivery should be improved to support the enterprises in making greater contributions to market competition, technological progress, economic development, and social stability. Specifically, the services in the following fields should be optimized.

(1) Technology finance and transfer. Market institutional arrangements for improving technology financial services include venture capital, loan support, credit guarantee, technology bond, and the growth enterprise market, while non-market institutional arrangements cover government subsidy, tax incentive, technological parks, and other supporting policies and capital guarantees. The technology transfer services can be optimized regarding technology evaluation, transaction, transfer, proxy, auction, and integration to evolve from being scattered and offline to being platform-based, market-based, and Internet-based. The Steinbeis Transfer Centers (STC), British Technology Group (BTG), and MATIMOP provide useful references.

(2) Information technology and data transaction. Cloud computing and big data have become hot spots in the information technology service industry. We need to facilitate the extensive application of major cloud computing service models such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS), and develop Business Process as a Service (BPaaS), Storage as a Service (STaaS), Security as a Service (SECaaS), Data as a Service (DaaS), and Network as a Service (NaaS). In addition, it is essential to upgrade Machine Learning as a Service (MLaaS) and Artificial Intelligence as a Service (AIaaS), and make overall deployment for and develop public, private, community, and mixed cloud markets for small- and medium-sized enterprises. The big data ecosystem composed of base layer, analysis layer, and application layer should be perfected, and the self-support, rental and sales, platform, warehouse, and crowd-sourcing models of data should be developed to give full play to the role of big data industry chain in technological innovation, structural adjustment, and resources sharing of small- and medium-sized enterprises.

(3) E-commerce and rights protection. As e-commerce has developed from the platform era to the overall transformation era, new open, sharing, inclusive, and collaborative concepts are shaping the new model of e-commerce brand competition. This trend decides the strategic direction—creating a comprehensive platform for enterprises, especially small- and medium-sized ones. During the "14th Five-Year Plan"

period, paid online content, membership-based, blockchain, cross-border, mobile, socializing, sharing, crowd-sourcing, industrial, logistics, and rural e-commerce should be developed to innovate the organizational form of industries, circulation methods of commodities, and modes of production and lifestyle. At the same time, efforts should be made to defend network security, data privacy, and consumer rights.

(4) Management consulting and comprehensive evaluation. During the "14th Five-Year Plan" period, improving the management competence of small- and medium-sized enterprises should be the top priority in the development of the emerging industries of strategic importance. Good management consulting and comprehensive evaluation is the soft power and hard task for an enterprise. Thus, we need to combine macro-monitoring with micro-monitoring, external diagnosis with self-diagnosis, quantitative analysis with qualitative analysis, and dynamic management with static management. We need to provide scientific, all-round, and comprehensive consulting and evaluation services to measure the capabilities of enterprises in business development, technological innovation, return on investment, risk prevention and control, capital appreciation, and fulfillment of social responsibility, and help them develop rapidly and healthily through timely detection and resolution of problems.

5 Policy research

Over the past decade, remarkable achievements have been made from a series of policies implemented from the central to local governments to promote the development of the emerging industries of strategic importance. These policies mainly involve fiscal taxation and finance, technological innovation, capital market, industrial fund, technology transfer, equipment technology, property rights protection, human resources, and government procurement. During the "14th Five-Year Plan" period, it is critical to maintain the continuity, stability, and sustainability of these effective policies. It should be noted that China has entered a stage when heavy and chemical industrialization, high-level processing, and technology intensification develop in parallel and has been moving towards advanced industrial foundation, rational industrial structure, and modernized industrial development. Considering that China has a super large market demand, a super large manufacturing capacity, and a supper large expected growth impetus, efforts should be made to deeply study the quality, quantity, temporal and spatial distribution, and evolution law of the emerging industries of strategic importance. On this basis, we should coordinate the research and implementation of industrial policies in the following aspects to further increase the productivity of enterprises and society.

(1) Industrial layout. The emerging industries of strategic importance should be arranged with full consideration to the categories, elements and division of labor of industries, as well as to the geographical distribution and location advantages of the industrial chain. The development order and linkage effect of resource-intensive, labor-intensive, capital-intensive, and technology-intensive industries should be fully understood. The positioning and goals, directions and priorities, and paths and measures of industrial development should be determined practically and realistically, and the regional layout, spatial structure, resource allocation, and input-output of industrial development should be optimized. In particular, the industrial structure convergence, blind investments, redundant industrial projects, and ecological damage must be prevented.

(2) Structural adjustment. Promoting economic structural adjustments of strategic importance should be a major and pressing task. The unbalanced structures of demand, supply, market, and growth in some places should be changed to support an orderly transition from painful structural adjustment to industrial economic transformation and towards innovation-driven development. We should compare and study structural changes and development trends of industry, research, enterprise, technology, talents, products, and employment at home and abroad, and try to meet benchmark standards in terms of strategic objectives, R&D and design, manufacturing processes, management technology, integrated innovation, growth impetus, and business modes.

(3) Economy of scale. To develop the emerging industries of strategic importance, we must firmly follow the new path of connotation-oriented extended reproduction and achieve economies of scale mainly by making scientific and technological progress, changing development methods, and improving the quality of workers. We need to set the goals for industrial output, growth, structure, quality, and adjustment with a scientific and rational approach, pursue high-standard planning, high-level construction, and high-quality development of industrial parks, industrial bases, and industrial clusters. The development of digital economy can be leveraged to vitalize stock economy, consumption economy, platform economy, sharing economy, rural economy, and small and micro-economy.

(4) Time sequence for construction. The time sequence arranged for the development of the emerging industries of strategic importance should allow for both current and long-term interests, needs and possibilities, investments and debts, and local and global development. Being realistic is always the golden rule. Full knowledge about the foundation, resource endowment, technical level, existing structure, demand intensity, and financial situation for local development is required. Thinking over carefully before taking actions and making overall arrangements is as important as doing all things necessary to with the best efforts. Over-investment, -construction, and -debt must be prevented. We must act in accordance with the laws of business cycles, industrial order, technological progress, priority development, and macro-control. We should strive to seize opportunities and pre-

vent risks, and do something important rather than do everything.

6 International competition

During the "14th Five-Year Plan" period, the accelerating world changes unseen in a century are complicated by the continuous impact of an unprecedented global pandemic. The economic, technological, cultural, security, and political landscapes of the world are undergoing profound changes, while China is still an important driver for global economic recovery and a major market for foreign direct investment. Its accession to the Regional Comprehensive Economic Partnership (RCEP) and being a party to the China-EU Investment Agreement will inject new life into global trade and investment. The emerging industries of strategic importance will play a deeper, wider, and more important role.

(1) Improving the level of trade in goods. China has the largest trade in goods in the world. As the largest exporter to more than 30 countries and the largest importer to more than 60 countries, China plays a pivotal role in the global industrial chain and supply chain. To further forge new international competition edges over trade in goods, China should strive to build comprehensive competitiveness centering technology, quality, standard, brand, and service, to cope with the challenges brought by trade protectionism and re-shoring of the manufacturing sector in developed countries, to prevent risks from overseas investments, futures trading, financing by going listed, exchange rate changes, and international settlement, and to improve the warning system and the emergency response mechanism to safeguard the industrial chain and supply chain.

(2) Optimizing the structure of trade in services. Since the "13th Five-Year Plan" period, China's average growth rate of trade in services has exceeded the world average and ranked the second in the world for five consecutive years. The development of service economy, the expansion of service consumption, and the increase in service exports in China have triggered fundamental changes to the structure of international trade. The continuous growth of technology-intensive, knowledge-intensive, and high-value-added service exports marks the advent of a golden development age for the service trade in China. China still needs to improve the service trade management system, optimize the structure of service export trade, help leading service trade companies to grow, develop new service trade platforms, expand open cooperation in service trade, and make the transportation, tourism, information technology, and financial service trade bigger, stronger, and better.

(3) Promoting the development of trade in intellectual property. Intellectual property trade, trade in goods, and service trade are three pillars of the World Trade Organization (WTO). Patent royalties and technology transaction fees are two main measures of intellectual property trade. The export value of these two measures from the United States, the European Union, and Japan accounts for more than 80% of the total in the world, while that from China accounts for only a small proportion and has been increasing year by year. Technological self-reliance should be the fundamental principle for the development of the emerging industries of strategic importance. With the goal of upgrading to the higher end of the global value chain, China should deploy in the technological innovation chain, the industrial upgrading chain, and the trade supply chain, and enhance the capabilities in the creation, use, protection, management, and service of intellectual property. It is essential to improve the anti-monopoly review system and the assistance mechanism for overseas intellectual property protection to prevent the abuse of intellectual property rights. Efforts should be made to promote improvements in international rules and standards for intellectual property and related trade and investment. With these measures, the import and export trade deficit reflected in patent royalties and technology transaction fees will be narrowed, which will promote China to move toward a powerhouse of intellectual property.

(4) Seizing the opportunity of digital trade. The new-generation digital technology has speeded up the arrival of a digital trade era, while its future impact on trade in the global value chain remains unpredictable. The digital trade in China has been sent into the positive track of rapid growth, and the emerging industries of strategic importance are faced a new opportunity from the development paradigm featuring dual circulation. At present, major developed countries have launched their digital trade strategies, and many new trends have emerged in digital trade rules. We have to study the measurement, standards, property rights, security, and interests of digital trade as well as related public, technical, and commercial issues under the framework of WTO, work with the international community to prepare early for the new wave of digital trade that is going to lead the world economy, and actively participate in developing global standards for international digital trade to enhance the right to speak.

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